Review Article

Coeliac plexus block for chronic pain syndromes

François Fugère MD FRCPC,*
Geraint Lewis MB BCh FRCPC

The purpose of this article is to familiarize the anaesthetist with the basic anatomy of the coeliac plexus; the techniques used to perform the procedure, its indications, complications and results in the management of chronic abdominal pain syndromes. Radiological, surgical and anaesthetic literature from the beginning of the century were reviewed. The main indication for neurolytic coeliac plexus block is intractable pain secondary to carcinoma of the pancreas or stomach. There appear to be theoretical advantages to techniques that result in spread of solution anterior to the aorta, such as the trans-aortic approach. These have not yet been demonstrated in any studies with large numbers of patients.

Le propos de cet article est de familiariser l'anesthésiste à l'anatomie de base du plexus coeliaque, aux techniques de réalisation du bloc, ses indications, ses complications et ses résultats dans la prise en charge des syndromes de douleurs abdominales chroniques. On revoit la littérature radiologique, chirurgicale et anesthésique à partir du début du siècle. La principale indication du bloc neurolytique du plexus coeliaque est la douleur réfractaire due au carcinome du pancréas ou de l'estomac. Il y aurait des avantages théoriques aux techniques qui consistent à diffuser la solution en avant de l'aorte, comme l'approche

trans-aortique. Aucune étude comprenant un grand nombre de patients n'a encore démontré ces avantages.

Malignant tumours originating from pancreas, stomach, liver, gallbladder, and lymph nodes, or chronic pancreatitis may cause abdominal pain which is unresponsive to large doses of narcotic analgesics, and which considerably impairs the patients' quality of life. Percutaneous coeliac block (CPB) has been used as an adjunct therapy in such cases¹⁻⁷ to produce reduction in narcotic requirements and in side effects, improving bowel motility and convert bedridden patients to ambulatory. Since its first description by Kappis in 1919,^{8,9} variations and refinements¹⁰ have taken place, including the use of radiography, to improve results and avoid complications, particularly when neurolytic drugs are used.

The purpose of this article is to review the basic anatomy of the coeliac plexus, the different techniques used to perform CPB, its indications, complications, and results in the management of chronic abdominal pain syndromes.

History

At the beginning of this century CPB was used as an alternative to general anaesthesia for upper abdominal surgery.⁹ The classic anterior approach consisted of anaesthetizing the abdominal wall with a field block prior to laparotomy, then depositing local anaesthetic directly on the plexus. However, it was difficult to obtain good surgical exposure in an unsedated anxious patient. A percutaneous anterior approach had been described by Wendling in 1917 but this was discouraged by the experts of the time because of the perceived risk of trauma to intra-abdominal structures. The posterior retro-crural approach described by Kappis in 1919⁷ was considered easier and safer, and became the standard with which all subsequent modifications are compared.

The indications for CPB are numerous (Table I)¹¹ but have become more specific over the years. Esmaurizzar in 1949¹² and Bonica in 1953³ recommended splanchnic

Key words

ANATOMY: coeliac plexus;
ANAESTHETIC TECHNIQUES: regional; coeliac plexus block;
CANCER;
PAIN: chronic.

From the Department of Anaesthesia, Main division, Ottawa Civic Hospital, Ottawa University, Ottawa, Ontario.

*Present address: Department of Anaesthesia, Maisonneuve-Rosemont Hospital, 5415 l'Assomption Blvd., Montreal, Quebec, Canada H1T 2M4.

Address correspondence to: Dr. Geraint Lewis, Department of Anaesthesia, Main division, Ottawa Civic Hospital, 1053 Carling Avenue, Ottawa, Ontario, Canada H1Y 4E9.

Accepted for publication 20th June, 1993.

TABLE 1 Historical indications of CPB

1 Vasospasm	
Raynaud's phenomenon	Hypertension
Ischaemic ulceration	Acute arterial occlusions
"Local shock"	Cerebrovascular accidents
Post-traumatic oedema	Head injuries
Angina pectoris	
2 Aid to growth or healing	
Short limbs from poliomyelitis	Charcot joints
Delayed union of fractures	Peptic ulceration
Sudeck's atrophy	
3 Modification of	
(a) Gastrointestinal secretions	
Pancreatitis, fibrocystic disease, peptic ulceration	
(b) Intestinal mobility	
Achalasia of cardia, pylorospasm, paralytic ileus	
Hirschsprung's disease	
4 Miscellaneous	
Hyperhydrosis	
Asthma	
Herpes zoster	
Subacromial bursitis	
Migraine	
Tabetic crises	
5 Pain	
Malignancy	Pancreatitis
Ischaemia	Phantom limb
Causalgia	"Sympathalgia"
"Angina abdominalis"	"Cystalgia"

block for the relief of chronic abdominal pain. Jones in 1957¹³ described the injection of alcohol for more permanent analgesia. Confirmation of the beneficial effects on intractable cancer pain of upper gastrointestinal origin was reported in numerous subsequent studies.^{1,2,4,6}

Following the description by Gorbitz in 1971² of the use of plain x-ray to facilitate CPB, radiology has become an integral part of the procedure, especially when neurolytic agents are to be used. Hegedus in 1979¹⁴ stressed the importance of fluoroscopic guidance for needle placement, which was later modified to include the injection of radiographic contrast material.¹⁵ Hagga¹⁶ and later, Moore⁴ after demonstrating the great variability in needle placement using the blind technique, recommended that CT scan should be used for any CPB. Ultrasound¹⁷ has also been used to verify needle placement and observe the spread of the injectate during CPB by the anterior approach.

Several modifications to the classic posterior retrocrural technique have been described including a transcrural⁶ and a transaortic approach.¹⁸ The percutaneous anterior approach has also enjoyed a renaissance due to

FIGURE 1 Constituents of the coeliac plexus. The plexus lies distal to the sympathetic relays in the coeliac group of ganglia. White fibres are shown in heavy line, grey fibres in slender line. (Reproduced with permission of Churchill Livingstone from Last R.J.; *Anatomy, Regional and Applied* 6th Ed.)

the development of fine needle techniques by radiologists.¹⁹⁻²¹

Anatomy

The terms solar plexus, abdominal brain of Bichat, coeliac ganglion, coeliac plexus and splanchnic plexus have been used to describe some or all of the same anatomy. A plexus consists of ganglia and interconnecting fibres that converge in a well-defined location. There are three major plexuses of the sympathetic nervous system; the cardiac plexus innervates thoracic structures, the coeliac plexus innervates abdominal organs, and the hypogastric plexus innervates pelvic organs.

The coeliac plexus, the largest of these, is composed of pre- and post-ganglionic sympathetic efferent, parasympathetic and visceral sensory afferent fibres (Figure 1). The pre-ganglionic sympathetic efferents come from the greater (T₅ to T₁₀), lesser (T₁₀ to T₁₁) and least (T₁₂) splanchnic nerves. These synapse in the coeliac plexus and from there, post-ganglionic fibres travel with blood vessels and subsidiary plexuses to innervate abdominal viscera.

The plexus also receives post-ganglionic sympathetic fibres from the first or second lumbar splanchnic nerve ganglia, parasympathetic fibres predominantly from the

FIGURE 2 Cross-section of the body at the level of L_1 indicates the placement of the needle in coeliac plexus block. (Reproduced with permission from Cousins M.J., Bridenbaugh P.O., *Neural Blockade in Clinical Anaesthesia and Management of Pain* 2nd Ed. J.B. Lippincott Co. 1988.)

right vagus, and sympathetic afferents from all the abdominal viscera except the left half of the colon, the rectum and the pelvic organs.^{22,23}

The coeliac plexus is situated in the epigastrium, posterior to the stomach and pancreas, and anterior to the crura of the diaphragm where it envelopes the origins of the coeliac, superior mesenteric arteries and the adjacent aorta at the level of the superior border of the L_1 vertebra (Figure 2).

The ganglia vary in number, size and location.^{24,25} Ward documented that ganglia varied in diameter from 0.5 to 4.5 cm and from 1 to 5 in number. Their position also varied from the level of the T_{12} - L_1 disc space to the middle of the L_2 vertebral body, the left ganglion being typically located slightly caudad to the right one.²⁶

Indications

The main indication for neurolytic coeliac plexus block (NCPB) is undoubtedly intractable pain secondary to carcinoma of the upper gastrointestinal tract. Use of neurolytic agents provides long-term relief for up to six months, that may match the life expectancy of the patient.^{1,2,4,17,27-29} The procedure should be considered when narcotic requirements start to escalate from previously stable dosage. Side effects of nausea, sedation, or any inability to tolerate narcotic therapy would also be indications to proceed with neurolysis.

The use of NCPB to relieve abdominal pain secondary to chronic pancreatitis, or other non-malignant conditions

gives equivocal results. The low long-term success rate, combined with the possibility of neurological complications, has dampened the enthusiasm of many, and most authors are reluctant to recommend it.^{15,19} Recent abstracts,³⁰ however, show a renewed interest in NCPB in these patients who are refractory to other forms of pain management. Coeliac plexus block with local anaesthetic and steroids has been used for acute pancreatitis pain relief³¹ but its efficacy in acute as well as chronic pancreatitis has yet to be confirmed in well randomized controlled studies.

Local anaesthetic CPB (LACPB) via the anterior approach has been used to provide visceral anaesthesia during interventional radiological procedures. Lieberman *et al.*²⁰ reported satisfactory visceral anaesthesia in ten of 18 interventional biliary radiological procedures, and Coldwell³² used LACPB to markedly reduce the epigastric pain following hepatic artery embolisation in unresectable primary and metastatic hepatic malignancies.

Finally LACPB combined with intercostal nerve blocks can be used either alone or in combination with general anaesthesia for upper abdominal surgery.²²

Techniques

All usual medications including narcotics should be continued in the preoperative period. Anticoagulants should be discontinued and return of normal haemostatic function assured. Sedatives and supplemental narcotics may be administered under direct supervision in the operating room. Some authors^{1,2,27} recommend discontinuation of antihypertensive drugs which could enhance the hypotensive effect of the block. This practice is controversial and is no longer required for patients undergoing general anaesthesia because of the risk of rebound hypertension and myocardial ischaemia.³³⁻³⁵ All patients should have appropriate intravenous access and haemodynamic and respiratory monitoring with ECG, blood pressure and pulse oximetry.

Posterior approach

The technique originally described by Kappis⁸ and refined by Moore⁴ involves placing needles posterior and cephalad to the diaphragm in the retro-crural space (Figure 3). The injectate spreads primarily cephalad, blocking the thoracic splanchnic, vagal and sensory afferents that converge to form the coeliac plexus.

The patient is positioned prone, with pillows placed beneath the iliac crests and chest, on a fluoroscopy table. The needle insertion sites, which are immediately caudad to the 12th rib, 7.5 cm lateral to the midline (and no further to avoid puncturing the kidney), are confirmed by placing markers and AP fluoroscopy. After subcutaneous infiltration of local anaesthetic, a 22 g 15 cm

FIGURE 3 The classic retrocrural approach to coeliac plexus block. Needle tips are positioned posterior (cephalad) to the diaphragm and the solution spreads primarily cephalad. (Reprinted by permission of Elsevier Science Publishing Co. Inc. from *Coeliac Plexus Block for Pancreatic Cancer: Anatomy and Technique* by Brown D.L., Moore D.C., *Journal of Pain and Symptom Management*, Vol. 3, No. 4, Fall 1988, 207. Copyright 1988 by the U.S. Cancer Pain Relief Committee.)

FIGURE 4 Guidelines to needle placement during retrocrural coeliac plexus block. The cross-sectional landmark for initial needle placement is found by maintaining a 45° angle from table top, and in line of 12th rib until the L₁ vertebral body is reached; then the needle is withdrawn and reinserted with an increased needle angle to allow the needle to be walked-off the vertebrae body anteriorly. (Reprinted by permission of Elsevier Science Publishing Co. Inc. from *Celiac Plexus Block for Pancreatic Cancer* by Brown D.L., Moore D.C., *Journal of Pain & Symptom Management* Vol. 3, No. 4, 208. Copyright 1988 by the U.S. Cancer Pain Relief Committee.)

spinal needle is inserted on the left side at an angle of 45 degrees from horizontal (Figure 4), and following the direction of the 12th rib medially, advanced until contact is made with the vertebral body of T₁₂ or L₁. The needle is then withdrawn somewhat and redirected to graze by the vertebral body to a point 1 to 2 cm beyond the an-

FIGURE 5 Radiographs showing needles in place for coeliac plexus block. Diffusion of 10 ml of 35% Diodrast injected through the R needle, with most of the spread being anterior to the anterior surface of L₁ and upper part of L₂ vertebrae. (Reproduced with permission from J.J. Bonica: *The Management of Pain*, 2nd Edition, Vol. 2, Philadelphia, Lea & Febiger 1990.)

terior margin of the vertebral body or until aortic pulsations are felt. The procedure is repeated on the right side, and three to five ml of contrast medium (e.g., Omnipaque 300) are injected, under fluoroscopy or CT-scan, through each needle after negative aspiration. Three images can usually be seen:³⁶

- 1 A blush that indicates the contrast medium is in muscle.
- 2 A blush that disappears quickly indicates intravascular placement.
- 3 Correct needle placement is indicated by an initial layering out of the dye in a narrow line along the anterior aspect of the vertebral column on the lateral view. This layering out is subsequently lost with increased volume of injectate and subsequent peri-aortic spread (Figure 5).

Then, after negative aspiration, a test dose of local anesthetic, e.g., 3 ml, lidocaine 2% may be given, prior to injection of the final solution either of more local anesthetic or neurolytic agent. This test dose will produce a reversible neurological deficit if the needle is positioned in a spinal artery³⁷ or subarachnoid space. A diagnostic CPB with up to 50 ml of local anaesthetic, e.g., bupivacaine 0.25%, is recommended by most authors.^{6,29,38-40} It may allow the physician to predict the efficacy of the block, to anticipate and correct technical problems and side effects that could supervene with NCPB. However, Jain *et al.*⁴¹ have demonstrated that a successful diagnostic block cannot predict the outcome of a neurolytic block in up to 28% of patients. The needle should be

cleared of neurolytic solution with air or saline before withdrawing to avoid tracking of solution along the needle path.

During the transcrural approach, the needle pierces the crus of the diaphragm to finish anterior and caudad to the diaphragm in the same plane as the aorta (Figure 6). Boas⁵ and Singler⁶ describe a two needle technique which consists of introducing the right needle through the crura by pushing it 1–2 cm further than the left one.

Ischia¹⁸ used a single needle transaortic technique, in which a needle introduced on the left side intentionally pierces the aorta until no blood can be aspirated, indicating that the needle tip now lies anterior to the aortic wall, and in the direct vicinity of the coeliac plexus (Figure 7). This introduces the risk of retroperitoneal haematoma. In the radiology literature, small haematomas are common after translumbar aortography, but clinically important bleeding has been reported in only 0.1 to 0.5% of cases where 20 g needles were used.^{42–45} The transaortic approach has the advantage of a definite end point for needle placement (cessation of blood return) and an apparent requirement for smaller volumes (15–30 ml) of neurolytic solution because of the closer proximity of the needle tip to the target, although this has yet to be confirmed by large clinical studies.

Anterior approach

The patient is positioned supine on a fluoroscopy table and the skin is infiltrated with local anaesthetic in the midline epigastrium down to peritoneum. A 20 gauge 15 cm needle is advanced perpendicular to the skin until the tip of the needle touches the vertebral body of L₁. The needle is then pulled back 1–2 cm and after negative aspiration, a few ml of contrast medium are injected under fluoroscopic,¹⁶ CT scan^{19,46} or ultrasound control¹⁷ (Figure 8). Twenty to 40 ml of local anaesthetic solution are then injected.

Intraoperative Injection

At the time of elective surgery for known or suspected pancreatic or other upper GI malignancy the surgeon may infiltrate periaortically at the level of the coeliac axis using 50 ml of neurolytic solution. The success rate with this approach may not be as good as with other methods.^{47,48} Possible explanations include difficult needle placement because of tumour location obscuring the surgical view or impairing the spread of injectate.^{17,48} More likely, is the lack of familiarity with correct needle placement or impaired spread of injectate due to altered tissue planes.^{17,48}

Injectate

Alcohol, in concentrations ranging from 50 to 100% is

FIGURE 6 The combined approach to coeliac plexus block, using the right-sided transcrural and left-sided retrocrural needle positions, with solutions spreading both caudad and cephalad. (Reproduced by permission of Elsevier Science Publishing Co. Inc. from *The use of neurolytic coeliac plexus block for pancreatic cancer: anatomy and technique* by Brown D.L., Moore D.C., *Journal of Pain and Symptom Management*, Vol. 3, No. 4, 207. Copyright 1988 by the U.S. Cancer Pain Relief Committee.)

FIGURE 7 Radiographs showing single needle transaortic coeliac plexus block with periaortic spread at the level of T₁₂ L₁ vertebrae following 10 ml of contrast medium.

the neurolytic drug of choice for CPB. Its mechanism of action is by extraction of cholesterol, phospholipid and cerebroside from the neural membrane and by precipitation of lipoproteins and mucoproteins.⁴⁹

Phenol $\geq 5\%$ in water causes protein coagulation and necrosis when applied directly to nerves. It is considered by some³⁸ to have a slightly slower onset of action, less efficacy and a shorter duration than other solutions.^{50,51} Phenol also seems to have a higher affinity for vascular tissue⁵⁰ which raises concern over its use in proximity to major blood vessels. Toxicity may occur with large amounts of phenol,⁵² in addition the viscosity of phenol makes the solution hard to inject. However, phenol in-

FIGURE 8 CT scan at the level of the coeliac trunk with spread of solution mainly in pre-aortic and pre-crural areas following a percutaneous anterior approach. A, aorta; C, crura of the diaphragm; c, contrast medium; S, stomach; T, coeliac trunk. (Reprinted by permission of Elsevier Science Publishing Co., Inc. from Matamala AM. The Percutaneous Anterior Approach to the Coeliac Plexus. Pain 34, 1988, 286 Figure 2.)

efficacy was challenged by others⁵³ using higher concentrations, and phenol as opposed to alcohol is easily miscible with contrast medium providing documentation of the distribution of injectate, a possible advantage.

The use of glycerol or ammonium salts in CPB has not been reported. Clinical trials of ammonium salts for other nerve blocks gave disappointing results with concentrations of 6–7% but recent reports using a 10% solution suggest good analgesia without loss of motor function can be achieved.²⁷ Although ammonium sulphate might be a neurolytic solution that decreases the incidence of neurological complications, its efficacy in CPB remains to be proved.

Different volumes have been recommended depending on the technique. The volume of injectate with the classic approach is usually of 25 ml through each needle or 50 ml^{4,54} if a single needle technique is used. This amount is necessary to reach the coeliac plexus and its subsidiary plexuses, but risks unwanted spread toward the spinal canal or lumbosacral plexus. The transaortic technique with placement of the needle directly into the coeliac plexus has the advantage that it only requires 15 to 30 ml of solution^{18,28} to achieve the block with a possible decreased incidence of complications.

Complications

Arterial hypotension and pain are the most common complications (Table II). Others that have been described usually result from needle misplacement.

Hypotension, most frequently orthostatic, is caused by

TABLE II Complications following NCPB

<i>Common</i>
Arterial hypotension
Pain
Transient diarrhoea
<i>Rare</i>
Neurological
- Neuralgia
- Impotence
- Loss of sphincter control
- Paresis or paralysis of lower limbs
Retroperitoneal haematoma
Pneumothorax
Pleural effusion
Kidney perforation
Rhabdomyolysis

loss of sympathetic tone resulting in splanchnic vasodilatation, pooling of blood in the splanchnic bed, and resultant decreased venous return to the heart. Symptomatic decrease in blood pressure necessitating treatment has been reported in 10–30% of cases^{18,22,39} and is more common in elderly, arteriosclerotic or hypovolaemic patients. Management consists of fluid administration, vasopressors, abdominal binders and support stockings.^{1,38,55} Compensation usually takes less than three days, which mitigates against the use of a day-care facility for the performance of these procedures. Our practice is to admit patients to hospital on the day of the procedure, and to discharge them when they are no longer symptomatically hypotensive, usually the following day.

Several types of pain have been reported following NCPB.^{1,36} The first may be a pressure or burning sensation in the epigastrium, chest, or mid-back immediately after the injection of neurolytic solution. This reaction lasts for up to 30 min and may be blunted by the concomitant administration of local anaesthetic or intravenous narcotics.

A second type of pain, experienced by most patients,^{1,36,38} is a dull aching back pain for up to 48 hr after the block. This is thought to be due to irritation of the diaphragm and back musculature by the injectate,^{38,39} and is easily controlled with oral analgesics.

Finally, there may be cramping bowel spasms secondary to the unopposed action of the parasympathetic system on the bowel which is already constipated and sluggish from high doses of narcotics. This can be eased by pre-block purgation but may still require continuation of narcotics for several days after the procedure.

If alcohol is used for neurolysis, patients will have a detectable blood alcohol concentration, and there may be a detectable alcohol odour on the breath for several hours after the procedure. The maximum level which

has been recorded is $0.021 \text{ g} \cdot 100 \text{ ml}^{-1}$,³⁹ which is about one fourth of the Canadian legal level for intoxication.

Serious neurological complications are uncommon but dramatic. Black¹¹ reported eight cases (7.7%) of weakness or numbness in the T₁₀ to L₂ nerve root distribution, and two cases (3.1%) of impotence. Thompson³⁹ described one episode (1%) of partial left leg paralysis in an obese, technically difficult patient. Owitz⁵⁵ reported two patients (1.4%) with dysaesthesia in the L₁ root distribution. Foot drop,⁴⁰ transient nerve root pain, and loss of anal and bladder sphincter control in single patients¹⁵ have also occurred. Brown⁴⁸ reported seven cases of complete paraplegia in the literature out of an unspecified number of cases.^{56,57}

Other uncommon complications include pleural effusion, pneumothorax, retroperitoneal haematoma, kidney perforation, tissue necrosis with rhabdomyolysis following intrapsoas injection, and retroperitoneal fibrosis after multiple injections.⁵⁸

Peritonitis secondary to NCPB has never been reported, and the concern about the "non-vigilant abdomen," that is, a patient with impaired intra-abdominal sensation and a concurrent acute surgical process leading to complications, seems only of theoretical interest.^{39,55}

Discussion

There are more than 20 series in the English literature on NCPB for control of pain from pancreatic cancer, other GI cancer or chronic pancreatitis. There are deficiencies in all reports:⁵⁹ most are not prospective, randomized or controlled. There is no information on the interval between diagnosis of pathology and performance of NCPB. Pre-block analgesic regimes are not mentioned, and this aspect has changed dramatically in the last decade with the introduction of long-acting oral opioids and a loss of fear regarding usage of long-term oral opioids. Neurolytic coeliac plexus block has never been compared with epidural or other intraspinal narcotic protocols.

A good definition of pain relief is often missing in most studies and methods of assessment are so different that comparison of results is very difficult, if not impossible. Overall, however, it seems that the success rate of NCPB is consistently high for pain from upper GI cancer, ranging from 44 to 94% with the classic technique, lasting from one month to one year (Table III). The rate of failure can be explained by technical problems, extension of primary tumour involving the abdominal wall not innervated by the coeliac plexus or the presence of metastases. In terms of complete long-term pain relief, NCPB is often not sufficient for upper GI cancer⁶⁰ because it only relieves the visceral component. However, it decreases pain, analgesic requirements and their side effects and improves the quality of life.^{1,11,39} It is con-

sidered by some authors to be the optimal treatment^{1,2,15,29,44} but it must be seen as a step in a combination therapy rather than an isolated treatment.

Pain relief is reported in 50 to 70% of patients with chronic pancreatitis, but these results are hard to assess as the natural history of the disease consists of periods of spontaneous remission. Long-term relief is limited, and the efficacy of subsequent blocks declines.¹⁵

Brown²⁹ assessed 136 patients undergoing NCPB retrospectively and found no difference in the incidence of successful block among the different radiographic techniques of verifying needle placement and a blind technique. These procedures were done by experienced practitioners, however, and it would seem prudent for the beginner or occasional practitioner to confirm needle position and spread of solution by x-ray. Some authors^{4,16,20,61} have recommended the routine use of CT-scan for NCPB. This is controversial,^{22,62} expensive, limits accessibility and there are no data to demonstrate improvement of success or fewer complications than with conventional techniques. It should be limited to patients with NCPB failure using other techniques.

Recently, Ischia⁶⁰ reported a prospective, randomized study where he assessed the efficacy and morbidity of three posterior percutaneous NCPB techniques in 61 patients with pancreatic cancer pain. He found no difference in terms of immediate or up-to-death results and morbidity between the transaortic plexus block, the classic retrocrural block and the bilateral chemical splanchnicectomy performed with use of fluoroscopy and contrast medium.

However, there appear to be at least theoretical advantages to techniques that emphasize spread of solution anterior to the aorta, directly at the level of the coeliac plexus. The transaortic technique has a reported success rate of between 85 to 93%.^{18,28,52} Two patients in the first Ischia series¹⁸ who did not respond were shown to have extensive cancer close to the aorta and subsequently responded to repeat block using a retro-crural approach. Pain reappeared within a month in an appreciable number of cases (25%). The neurolytic agent used was alcohol, so there was no apparent reason for faster nerve regeneration. This may represent growth of the primary tumour or the appearance of metastases. In the Lieberman study, of the 91% reported success rate, 53% continued the use of narcotics even if they considered their pain to be much improved.

The percutaneous anterior approach has a success rate of 67%²⁰ and 78%.³² It has the advantage that the supine position is more comfortable for patients than the prone. However, it involves penetration of abdominal viscera and blood vessels, and although the reported incidence of complications is low, more data are needed to establish the safety and efficacy of this technique.

TABLE III Comparison of results with NCPB*

Author	Technique	Indications	Number	Percentage pain relief		
				Good	Fair	Poor
Bridenbaugh (1964) ¹	Classic technique	Pancreatic cancer	25	88	8	4
		Other GI cancer	16	94	6	0
Black (1973) ¹¹	Classic technique	Pancreatic cancer	18	70	30	0
		Other GI cancer	35	70	17	13
		Chronic pancreatitis	15	64	4	32
Thompson (1977) ³⁹	Classic technique	Abdominal cancer	97	78	16	6
		Chronic pancreatitis	3	0	0	100
Jones (1977) ⁷	Classic technique	Abdominal cancer	100	80	11	9
Hegedus (1979) ¹⁴	Classic technique	Pancreatic cancer	36	44	42	14
		Chronic pancreatitis	9	33	22	45
Moore (1979) ³⁸	Classic technique	Abdominal cancer	168	83	11	6
Leung (1983) ¹⁵	Classic technique	Pancreatic cancer	13	85	15	0
		Chronic pancreatitis	23	52	26	22
Ischia (1983) ¹⁸	Transaortic technique	Abdominal cancer	28	68	25	7
Owitz (1983) ⁵⁵	Classic technique	Pancreatic cancer	80	85	–	–
		Chronic pancreatitis	50	70	–	–
Brown (1989) ⁴⁰	Classic technique	Pancreatic cancer	136	85	–	–
		Other abd. cancer	66	73	–	–
Lieberman (1990) ²⁸	Transaortic technique	Abdominal cancer	124	43	48	9
Ischia (1992) ⁶⁰	Transaortic technique	Pancreatic cancer	20	55	30	15
	Classic technique	Pancreatic cancer	20	60	35	5
	Splanchnicectomy	Pancreatic cancer	21	71	24	5
All mean		Pancreatic cancer	369	77	16	7
		Abdominal cancer	634	72	20	8
		Chronic pancreatitis	100	59	8	33

Good: Complete pain relief or significant improvement of at least one month or until death.

Fair: Improvement, complete pain relief of very short duration (< one week) or improvement necessitating narcotics for pain relief.

Poor: No relief at all or very mild improvement.

– Not assessed.

*Studies of at least 25 patients.

The overall incidence of neurological complications is difficult to determine because, of all the cases reported, the total number of NCPB done is unknown. The incidence of the largest group reported from the Mason Clinic^{1,29,39,40} over 25 yr was 0.6% (2 of 343 patients). Total or partial motor paralysis may follow unintentional subarachnoid or epidural injection, or posterior spread of neurolytic solution toward thoracic or lumbar somatic nerves. Paraplegia may also occur subsequent to thrombosis of a major feeder artery to the spinal cord.⁶³ Impotence may be secondary to superior hypogastric plexus involvement.¹¹

If posterior spread of injectate is responsible for the majority of neurological complications, a decreased incidence might be expected with the anterior or transaortic approach where a smaller amount of solution is injected

well away from the spinal cord and somatic nerve roots. The absence of neurological complications with the transaortic technique in 272 patients^{18,20,59,64} suggests that this may indeed be the case.

Conclusion

Percutaneous coeliac plexus block is an important tool in the management of patients with upper GI malignancy in whom the pain is not responsive to oral narcotics or who develop important side effects to these. The transaortic technique of NCPB is an alternative to the classic technique and presents many advantages. The definite end point of cessation of blood return following transfixion of the aorta makes it easier to perform, and the single needle technique makes it less painful for the patient. By injecting directly into the plexus, the success

rate is very good and smaller volumes of injectate may be used and thus minimize the potential for major neurological complications.

As anaesthetists familiar with nerve blocking techniques, we should overcome our fear of this technically easy procedure to decrease the suffering experienced by patients dying with upper GI malignancies.

References

- 1 *Bridenbaugh L, Moore DC, Campbell DD.* Management of upper abdominal cancer pain: treatment with celiac plexus block with alcohol. *JAMA* 1964; 190: 877-80.
- 2 *Gorbits C, Leavens ME.* Alcohol block of the celiac plexus for control of upper abdominal pain caused by cancer and pancreatitis. Technical note. *J Neurosurgery* 1971; 34: 575-9.
- 3 *Bonica JJ.* The Management of Pain. 1st ed. Philadelphia: Lea & Febiger, 1953.
- 4 *Moore DC, Bush WH, Burnett LL.* Celiac plexus block: a roentgenographic, anatomic study of technique and spread of solution in patients and corpses. *Anesth Analg* 1981; 60: 369-79.
- 5 *Boas RA.* The sympathetic nervous system and pain relief. In: Swerdlow M (Ed.). *Relief of Intractable Pain*, New York: Elsevier, 1983; 215-37.
- 6 *Singler RC.* An improved technique for alcohol neurolysis of the celiac plexus. *Anesthesiology* 1982; 56: 137-41.
- 7 *Jones J, Gough D.* Coeliac plexus block with alcohol for relief of upper abdominal pain due to cancer. *Ann Rev Coll Surg Eng* 1977; 59: 46-9.
- 8 *Kappis M.* Sensibilität und lokale anästhesie im chirurgischen gobeet der bauchhöhle mit besonderer berticksichtigung der splanchnicusanästhesia. *Beitr Klin Chir* 1919; 115: 161-75.
- 9 *Labat G.* Regional Anaesthesia: Its Technic and Clinical Applications. Philadelphia: WB Saunders, 1924.
- 10 *Moore DC.* Regional Block; A Handbook for Use in the Clinical Practice of Medicine and Surgery. 3rd ed. Springfield: Charles C. Thomas, 1961.
- 11 *Black A, Dwyer B.* Coeliac plexus block. *Anaesth Intensive Care* 1973; 1: 315-8.
- 12 *Esnaurrizar ML.* The surgical relief of abdominal pain by splanchnic block. *Ann R Coll Surg Eng* 1959; 4: 192-4.
- 13 *Jones RR.* A technic for injection of the splanchnic nerves with alcohol. *Anesth Analg* 1957; 36: 75-7.
- 14 *Hegedüs V.* Relief of pancreatic pain by radiography-guided block. *American Journal of Radiology* 1979; 133: 1101-3.
- 15 *Leung JW, Bowen-Wright M, Aveling W, Shorvon PJ, Cotton PB.* Coeliac plexus block for pain in pancreatic cancer and chronic pancreatitis. *Br J Surg* 1983; 70: 730-2.
- 16 *Haaga JR, Reich NE, Havrilla TR, Alfidi RJ.* Interventional CT-scanning. *Radiol Clin North Am* 1977; 15: 449-56.
- 17 *Montero Matamala A, Vidal Lopez F, Aguilar Sanchez JL, Donoso Bach L.* Percutaneous anterior approach to the coeliac plexus using ultrasound. *Br J Anaesth* 1989; 62: 637-40.
- 18 *Ischia S, Luzzani A, Ischia A, Faggion S.* A new approach to the neurolytic block of the coeliac plexus: the transaortic technique. *Pain* 1983; 16: 333-41.
- 19 *Herpels V, Kurdziel JC, Dondelinger RF.* Percutaneous CT guided nerve block of the coeliac plexus and splanchnic nerves. *Ann Radiol (Paris)* 1988; 31: 291-6.
- 20 *Lieberman RP, Nance PN, Cuka DJ.* Anterior approach to celiac plexus block during interventional biliary procedures. *Radiology* 1988; 167: 562-4.
- 21 *Derhy S, Couderc T, Begon C, Roche A.* Neurolyse coeliaque abord antérieur et guidage tomodensitométrique: une technique simple et logique. *Ann Radiol* 1989; 32: 230-3.
- 22 *Thompson GE, Moore DC.* Celiac plexus, intercostal and minor peripheral blockade. In: Cousins M, Bridenbaugh PO (Eds.). *Neural Blockade in Clinical Anaesthesia and Management of Pain*, 2nd ed., Philadelphia: Lippincott, 1988; 515-20.
- 23 *Laugner B.* Blocs du système nerveux sympathique. In: Gauthier-Lafaye P (Ed.). *Précis d'Anesthésie Loco-Régionale*, 2nd ed., Paris: Masson, 1988; 354-80.
- 24 *Hovelacque A.* Anatomie des Nerfs Craniens et Rachidiens et du Système Grand Sympathique Chez l'Homme. Paris: Dorn & Cie., 1927.
- 25 *Paz S, Rosen A.* The human celiac ganglion and its splanchnic nerves. *Acta Anat (Basel)* 1989; 136: 129-33.
- 26 *Ward EM, Rorie DK, Nauss LA, Bahn RC.* The celiac ganglia in man: normal anatomic variations. *Anesth Analg* 1979; 58: 461-5.
- 27 *Bonica JJ, Buckley PF, Moricca G, Murphy TM.* Neurolytic blockade and hypophysectomy. In: Bonica JJ (Ed.). *The Management of Pain*, 2nd ed., Philadelphia: Lea and Febiger, 1990; 1980-2039.
- 28 *Lieberman RP, Waldman SD.* Celiac plexus neurolysis with the modified transaortic approach. *Radiology* 1990; 175: 274-6.
- 29 *Brown DL, Bulley CK, Quiel EL.* Neurolytic celiac plexus block for pancreatic cancer pain. *Anesth Analg* 1987; 66: 869-73.
- 30 *Hastings RH, McKay WR.* Treatment of benign chronic abdominal pain with neurolytic celiac plexus block. *Anesthesiology* 1991; 75: 156-8.
- 31 *Kennedy SF.* Celiac plexus steroids for acute pancreatitis. *Reg Anesth* 1983; 8: 39-40.
- 32 *Coldwell DW, Loper KA.* Regional anaesthesia for hepatic arterial embolization. *Radiology* 1989; 172: 1039-40.

- 33 Slogoff S, Keats AS, Ott E. Preoperative propranolol therapy and aortocoronary bypass operation. *JAMA* 1978; 240: 1487-90.
- 34 Pontén J, Haggendal J, Milocco I, Waldenstrom A. Long-term metoprolol therapy and neuroleptanaesthesia in coronary artery surgery: withdrawal vs maintenance of β_1 -adrenoreceptor blockade. *Anaesth Analg* 1983; 62: 380-90.
- 35 Matangi MF, Strickland J, Garbe GJ, et al. Atenolol for the prevention of arrhythmias following coronary artery bypass grafting. *Can J Cardiol* 1989; 5: 229-34.
- 36 Abram SE (Ed.). *The Pain Clinic Manual*. Philadelphia: J.B. Lippincott Company, 1990.
- 37 Bowen Wright RM. Precautions against injection into the spinal artery during coeliac plexus block (Letter). *Anaesthesia* 1990; 45: 247-8.
- 38 Moore DC. Celiac (splanchnic) plexus block with alcohol for cancer pain of the upper abdominal viscera. In: Bonica JJ, Ventafridda V (Eds.). *Advances in Pain Research and Therapy*, New York: Raven Press, 1979; 357-71.
- 39 Thompson GE, Moore DC, Bridenbaugh LD, Artin Ry. Abdominal pain and alcohol celiac plexus nerve block. *Anesth Analg* 1977; 56: 1-5.
- 40 Brown DL. A retrospective analysis of neurolytic celiac plexus block for nonpancreatic intra-abdominal cancer pain. *Reg Anesth* 1989; 14: 63-5.
- 41 Jain S, Chiang J, Vanderslice T. Is diagnostic block necessary prior to neurolytic celiac plexus block? *Anesthesiology* 1991; 75: A749.
- 42 Chuang VP, Fried AM, Chen CQ. Computed tomographic evaluation of para-aortic hematoma following translumbar aortography. *Radiology* 1979; 130: 711-2.
- 43 Bergman AB, Neiman HL. Computed tomography in the detection of retroperitoneal hemorrhage after translumbar aortography. *AJR* 1978; 131: 831-3.
- 44 McAfee JG. A survey of complications of abdominal aortography. *Radiology* 1957; 68: 825-38.
- 45 Hessel SJ, Adams DF, Abrams HL. Complications of angiography. *Radiology* 1981; 138: 273-81.
- 46 Montero Matamala A, Vidal Lopez F, Imaraja L. The percutaneous anterior approach to the coeliac plexus using CT guidance. *Pain* 1988; 34: 285-8.
- 47 Coombs DW, Savage S. Persistent pain following intraoperative celiac plexus neurolysis. *Clin J Pain* 1985; 1: 155-7.
- 48 Brown DL, Moore DC. The use of neurolytic celiac plexus block for pancreatic cancer: anatomy and technique. *Journal of Pain and Symptom Management* 1988; 3: 206-9.
- 49 Rumsby MG, Finegan JB. The action of organic solvents in the myelin sheath of peripheral nerve tissue. II Short chain aliphatic alcohols. *J Neurochem* 1966; 13: 1509-11.
- 50 Wood KM. The use of phenol as a neurolytic agent: a review. *Pain* 1978; 5: 205-29.
- 51 Mandl F. Aqueous solution of phenol as substitute for alcohol in sympathetic block. *J Int Coll Surg* 1950; 13: 566-8.
- 52 Gaudy JH, Tricot C, Sezeur A. Troubles du rythme cardiaque graves après phénolisation splanchnique peropératoire. *Can J Anaesth* 1993; 40: 357-9.
- 53 Cousins MJ, Reeve TS, Glynn CJ, Walsh JA, Cherry DA. Neurolytic lumbar sympathetic blockade: duration of denervation and relief of rest pain. *Anesth Intensive Care* 1979; 7: 121-35.
- 54 Filshie J, Golding S, Robbie DS, Husband JE. Unilateral computerized tomography guided coeliac plexus block: a technique for pain relief. *Anaesthesia* 1983; 38: 498-503.
- 55 Orwitt S, Koppolu S. Celiac plexus block: an overview. *Mt Sinai J Med* 1983; 50: 486-90.
- 56 Galizia EJ, Lahiri SK. Paraplegia following coeliac plexus block with phenol. *Br J Anaesth* 1974; 46: 539-40.
- 57 Cherry DA, Lamberty J. Paraplegia following coeliac plexus block. *Anaesth Intensive Care* 1984; 12: 59-61.
- 58 Pateman J, Williams MP, Filshie J. Retroperitoneal fibrosis after multiple celiac plexus blocks. *Anaesthesia* 1990; 45: 309-10.
- 59 Sharfman WH, Walsh TD. Has the analgesic efficacy of neurolytic celiac plexus block been demonstrated in pancreatic cancer pain? *Pain* 1990; 41: 267-71.
- 60 Ischia S, Ischia A, Polati E, Finco G. Three posterior percutaneous celiac plexus block techniques: a prospective, randomized study in 61 patients with pancreatic cancer pain. *Anesthesiology* 1992; 76: 534-40.
- 61 Buy JN, Moss AA, Singler RC. CT guided celiac plexus and splanchnic nerve neurolysis. *J Comput Assist Tomogr* 1982; 6: 315-9.
- 62 Frost EA, Goldiner PL, Lu G. CT scan and celiac plexus block (Letter). *Anesthesiology* 1988; 68: 968-9.
- 63 Woodham MJ, Hanna MH. Paraplegia after coeliac plexus block. *Anaesthesia* 1988; 44: 487-9.
- 64 Feldstein GS, Waldman SD, Allen ML. Loss of resistance technique for transaortic celiac plexus block (Letter). *Anesth Analg* 1986; 65: 1092-3.